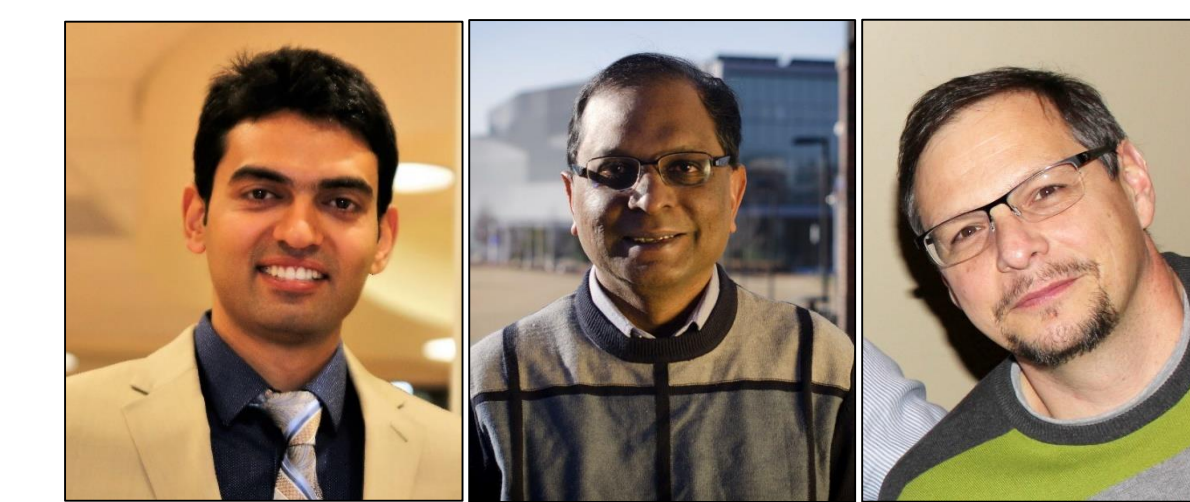




NC STATE UNIVERSITY

Recipe to synthesize aerogels with tunable properties: from design principles to application



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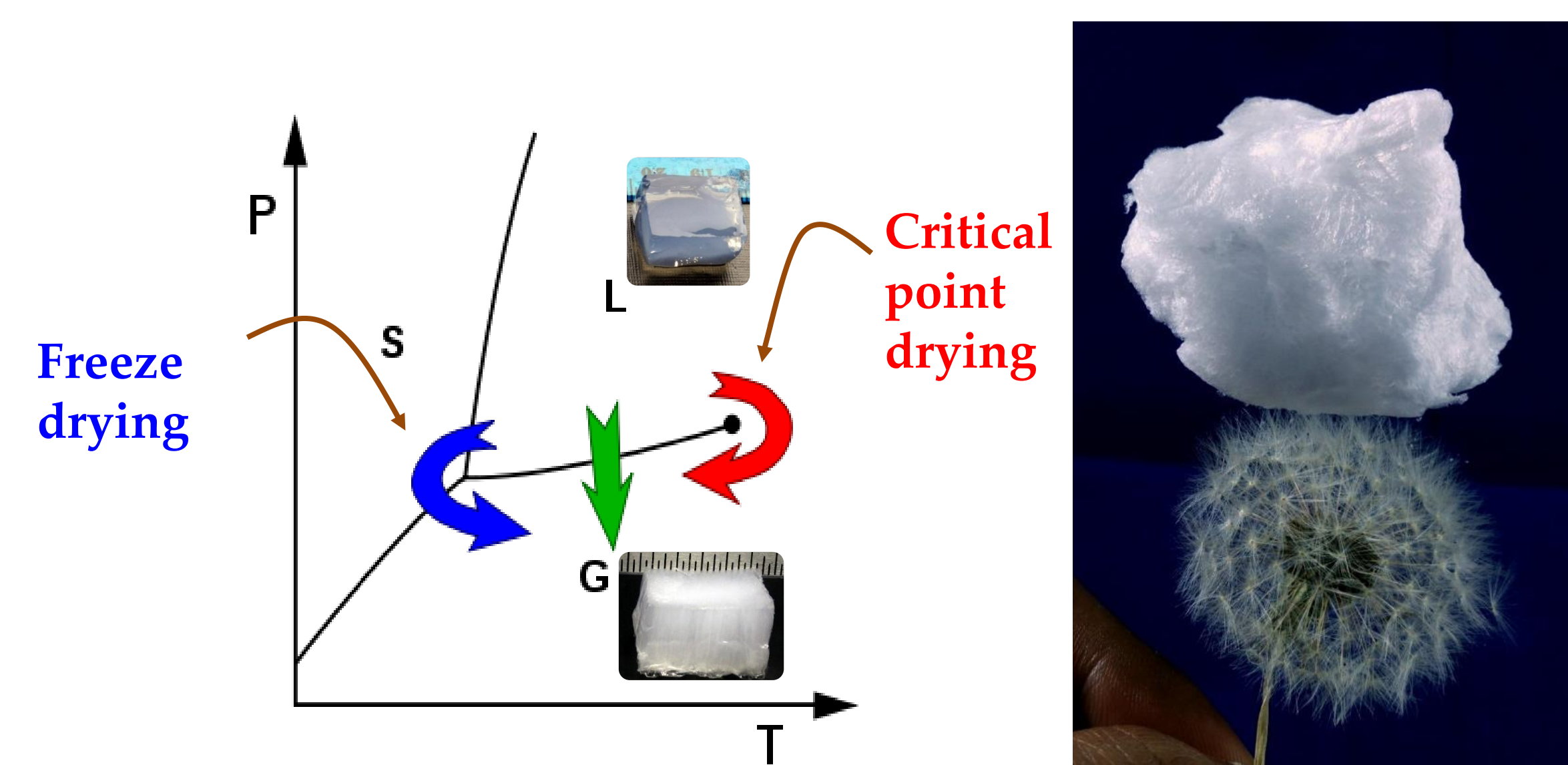
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BACKGROUND

Aerogel- Is it magic?

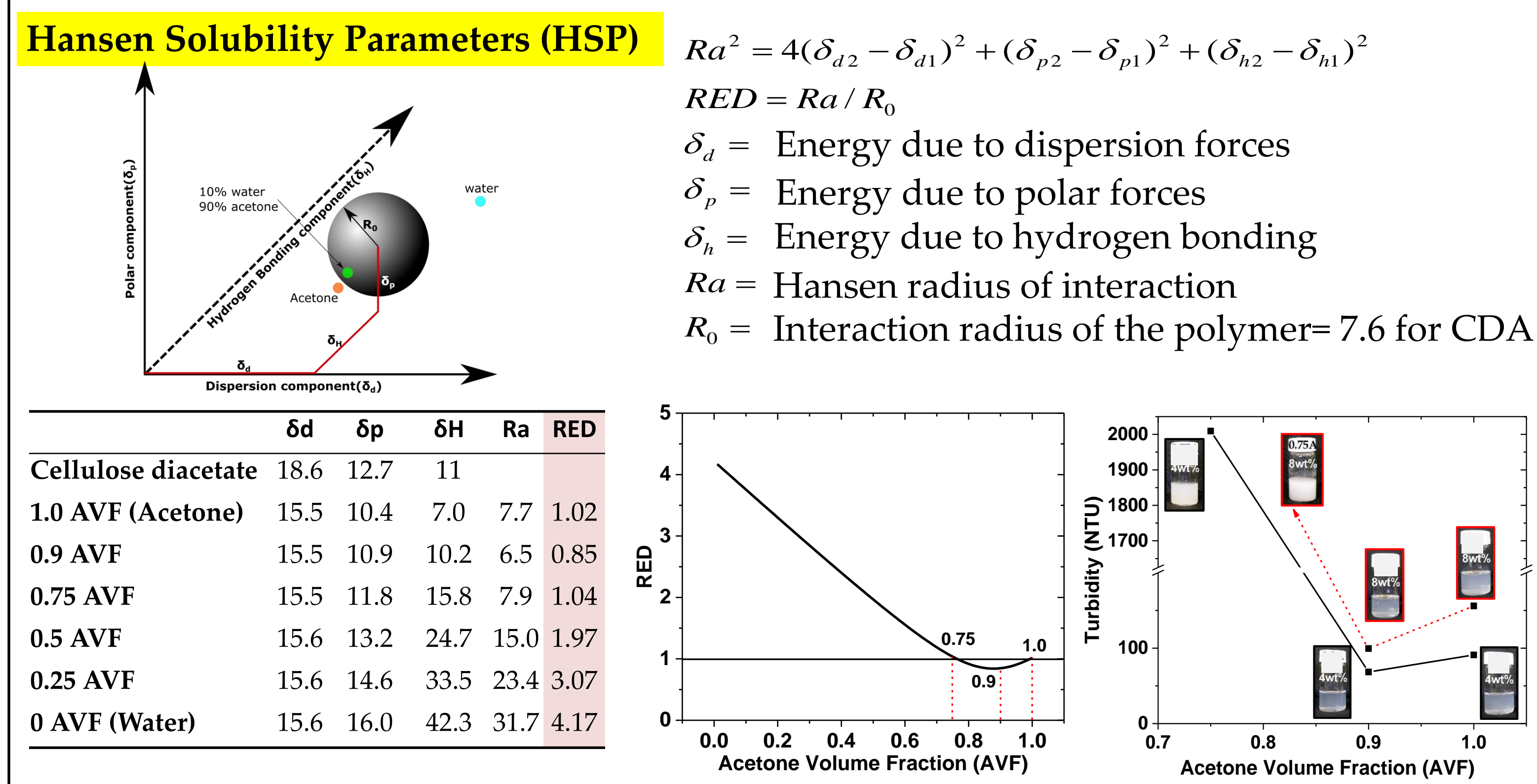
Transitioning solvent from liquid to gaseous state avoiding capillary forces to prevent structural collapse



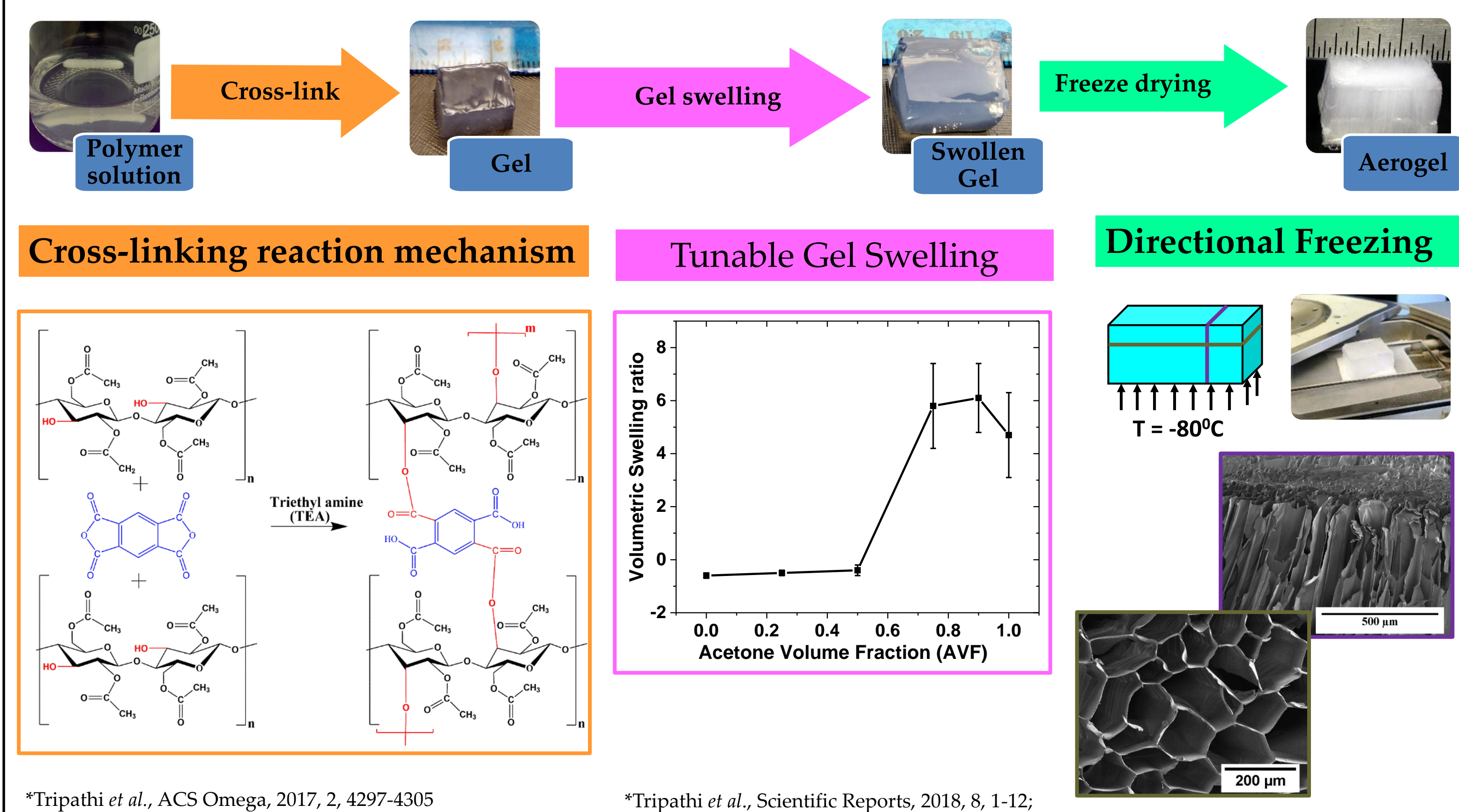
*Tripathi et al., ACS Omega, 2017, 2, 4297-4305

APPROACH & RESULTS

Can we predict and control swelling?



Can HSP translate to polymer gels?



APPLICATION & CONCLUSIONS

Cool! What to do with these Aerogels?

Aerogels with tunable mechanical properties can be used in variety of applications such as **shock absorbers, thermal and acoustic insulators** among many others. Here, a special focus is on **oil-spill remediation**

2010 Deep Water Horizon Spill



- 2010 Deep Water Horizon Spill: **210 million gallons of crude oil** gushed into gulf of Mexico for 3 months.¹
- Cost to BP: Above **\$40 billion** including civil and criminal settlements.¹

¹Graham B et al., Deep Water: The Gulf Oil Disaster and the Future of Offshore Drilling; 2011
*Images Source: google.com

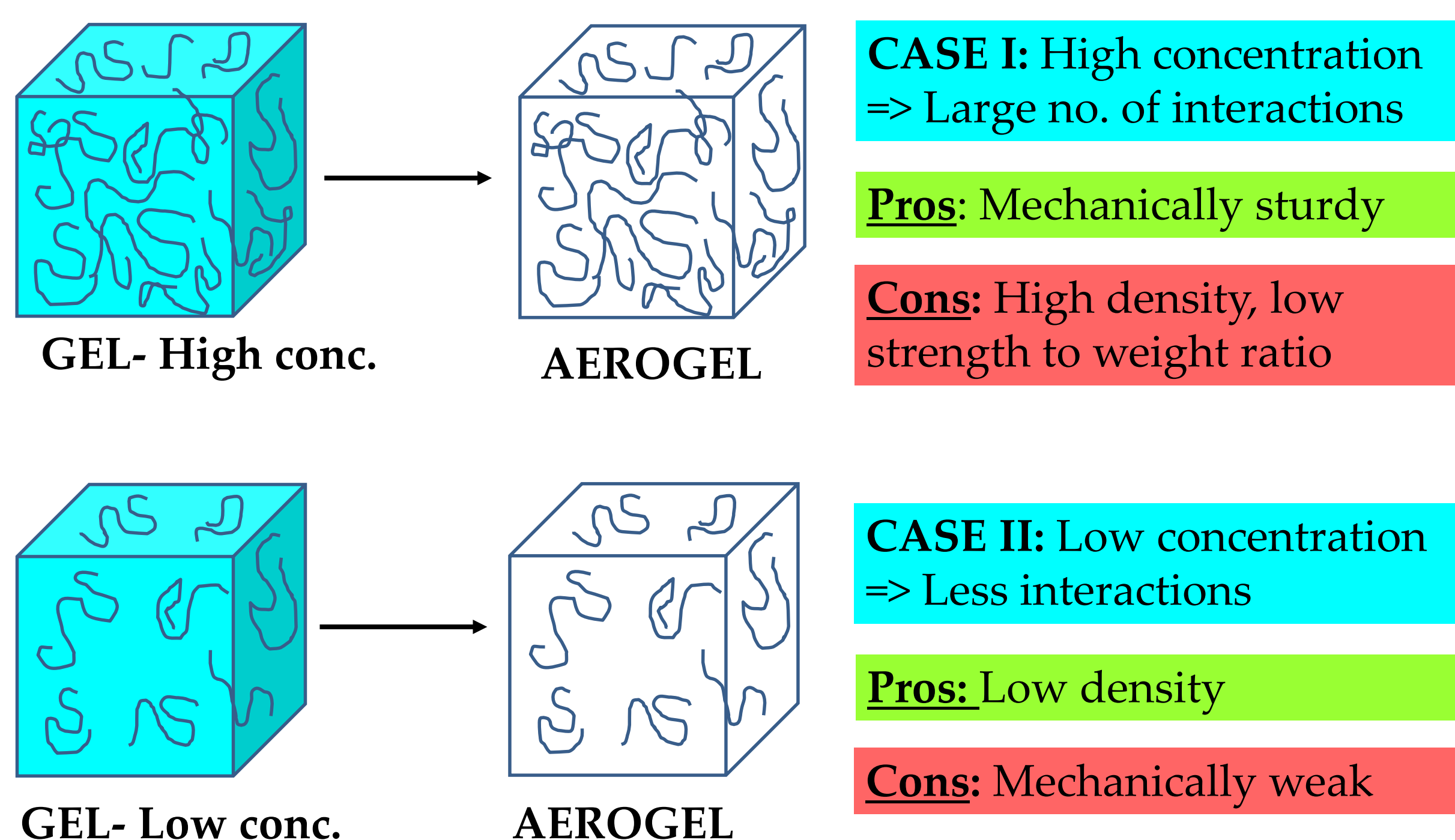
Current methods for cleanup



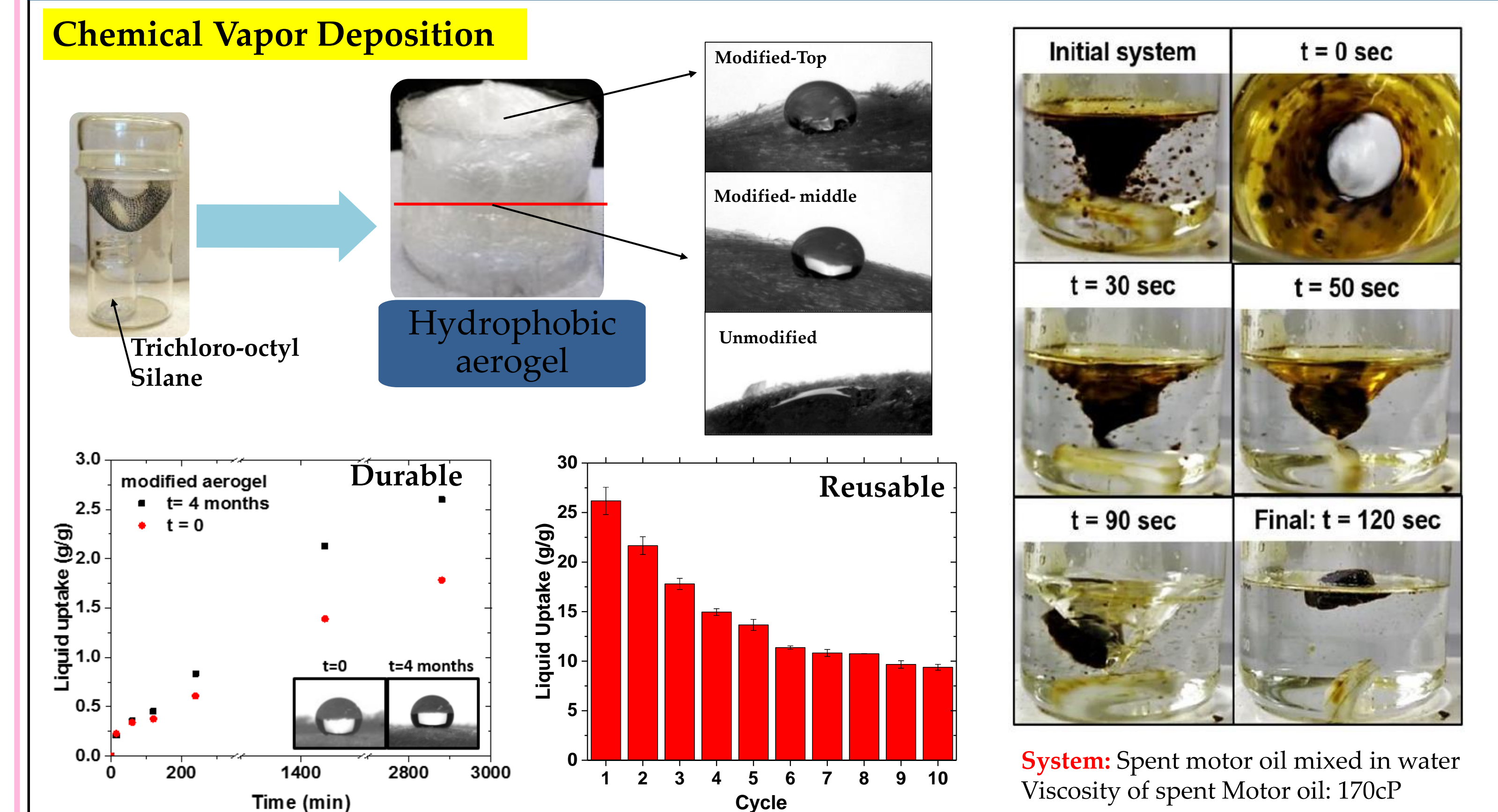
Methods are either **inefficient** or **environmentally unfriendly**.

Biggest challenge!

Tuning density without compromising mechanical integrity

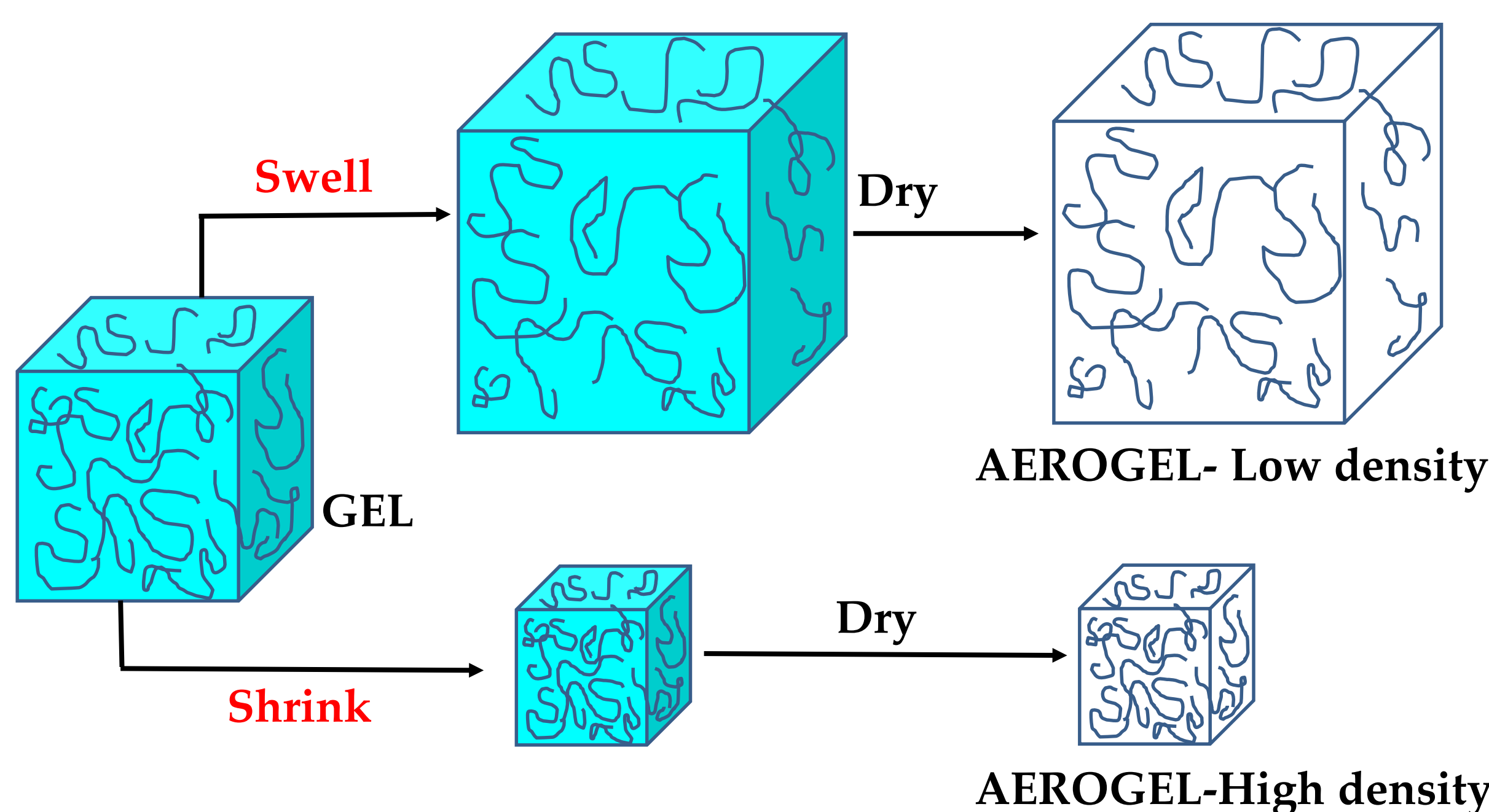


Oil-spill cleanup

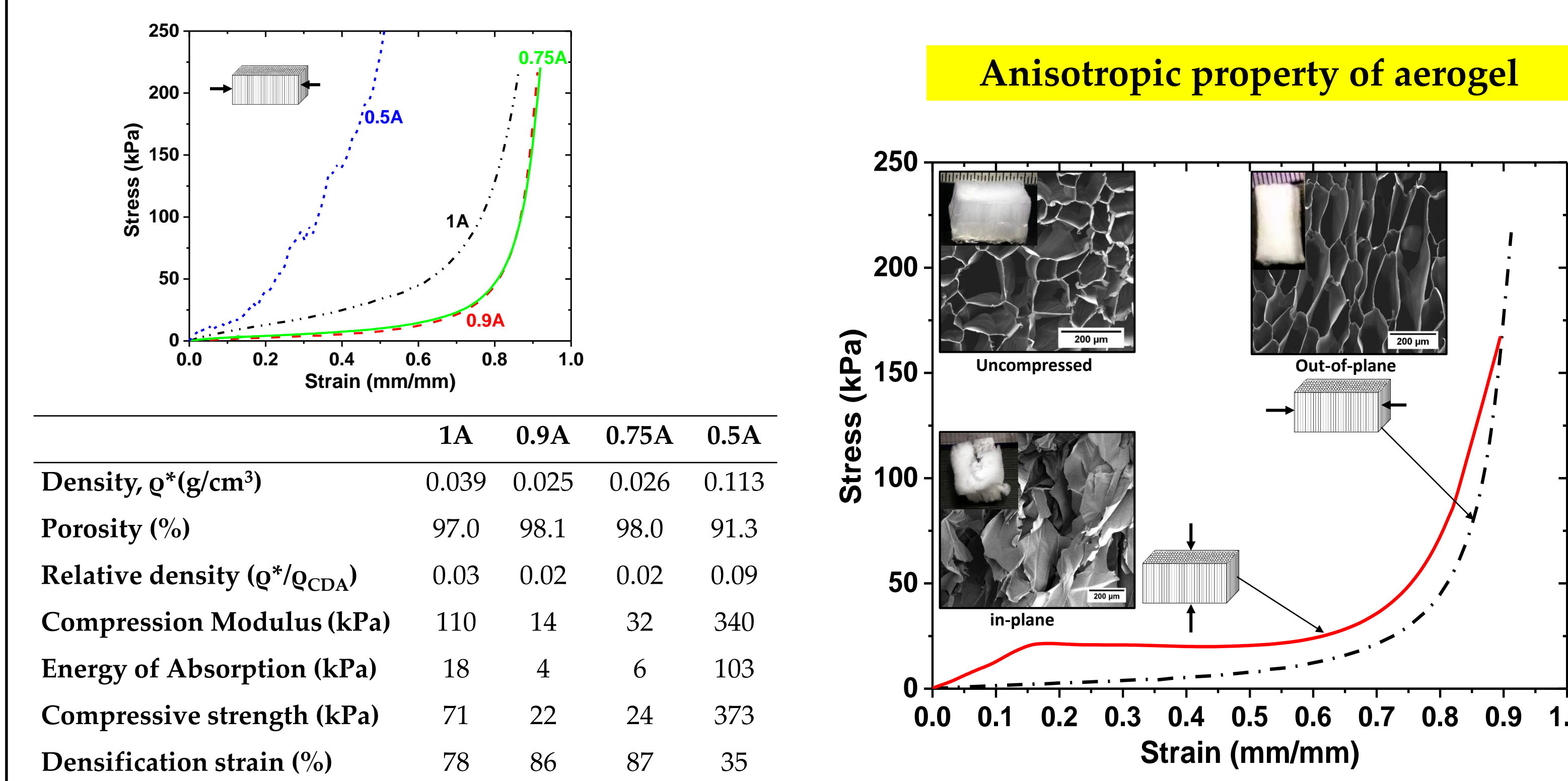


How to overcome it?

Controlled swelling/ shrinking of precursor gel before drying



Aerogels with tunable properties



Conclusions

1. Invoked HSP to tune organogel swelling and hence aerogel properties.
2. A wide range of mechanical properties achieved by the novel approach of controlled swelling.
3. Directional freezing to induce anisotropy in aerogels
4. Modified aerogel are durable and reusable with high oil recovery and retention even in an agitated environment.

Acknowledgements

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2. My research group members both in Khan and Rojas group for their continuous support.